

PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing: 03 February 2000 (03.02.00)	
International application No.: PCT/EP98/04563	Applicant's or agent's file reference: PCT 900-009/00
International filing date: 21 July 1998 (21.07.98)	Priority date:
Applicant: DYBKJAER, Ib et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International preliminary Examining Authority on:
16 April 1999 (16.04.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not



made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer: J. Zahra Telephone No.: (41-22) 338.83.38
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PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PCT 900-009/ej		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP98/04563	International filing date (day/month/year) 21/07/1998	Priority date (day/month/year) 21/07/1998
International Patent Classification (IPC) or national classification and IPC C01B3/38		
Applicant HALDOR TOPS E A/S et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 1 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input checked="" type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand 16/04/1999		Date of completion of this report 27.09.99
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer Schmidt, O Telephone No. +49 89 2399 8438 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP98/04563

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-6 as originally filed

Claims, No.:

2 as originally filed

1 as received on 08/09/1999 with letter of 08/09/1999

Drawings, sheets:

1/2,2/2 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP98/04563

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-2
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-2
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-2
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

SECTION V.:

1.

- 1.1 The following documents D1 and D2 are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1 = EP-A-0 440 258

D2 = PATENT ABSTRACTS OF JAPAN vol. 017, no. 551 (C-1117), 5 October 1993 & JP 05 155602 A (SEKIYU SANGYO KASSEIKA CENTER; OTHERS: 01), 22 June 1993

- 1.2 D1 discloses a process for steam reforming hydrocarbons by passing the hydrocarbon feedstock into a tubular reactor consisting of a series of elongated tubes filled with conventional steam reforming Ni and/or noble metal catalysts and which is being heated by burning of fuel thereby obtaining a partially steam reformed gas effluent which in turn is passed to an adiabatic reactor to produce a product gas rich in CO and H₂ (cf. D1; page 3, lines 27-32; page 4, line 31 to page 5, line 12). D1 differs from the presently claimed process in that a steam reforming catalyst is supported as a thin film on the walls of a tubular reactor and furthermore D1 lacks utilization of waste heat in the flue gas from the primary steam reformer by heating a thin film catalyst. D2 discloses a process for steam reforming hydrocarbons by passing hydrocarbon feedstock into a reactor being heated by catalytic combustion of fuel and composed of concentrically set plate-fin compartments provided with a thin-film steam-reforming catalyst. D2 differs from the presently claimed process in that it does not suggest any means for utilizing hot flue gas from the tubular reactor in a thin film catalyst steam-reforming reactor. (cf. D2; abstract).

The subject-matter of claims 1 to 2 meets the requirements of Article 33(2)(3)(4) PCT.

SECTION VII.:

2. The term "RKNR nickel steam reforming catalyst" used on page 5 of the

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP98/04563

description appears to be a registered trade mark.

International Patent Application PCT/EP98/04563
Applicant: HALDOR TOPSØE A/S
PCT 900-00993/lh
Date: 7 September, 1999

NEW CLAIM 1

1. Process for the preparation of hydrogen and carbon monoxide rich gas by steam reforming of a hydrocarbon feedstock in the presence of a steam reforming catalyst supported as thin film on the wall of a reactor, comprising the steps of
 - (a) passing a process gas of hydrocarbon feedstock through a first reactor (10) with a thin film of steam reforming catalyst supported on walls of the reactor (10) in a heat conducting relationship with a hot gas stream of flue gas;
 - (b) passing effluent from the first reactor (10) to a subsequent tubular reactor (14) being provided with a thin film of steam reforming catalyst and/or steam reforming catalyst pellets and being heated by burning of fuel, thereby obtaining a partially steam reformed gas effluent and the hot gas stream of flue gas;
 - (c) passing the effluent from the second reactor (14) to an autothermal reformer (16); and
 - (d) withdrawing from the autothermal reformer (16) a hot gas stream of product gas (20) rich in hydrogen and carbon monoxide.

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference PCT 900-009/00	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/EP 98/ 04563	International filing date (day/month/year) 21/07/1998	(Earliest) Priority Date (day/month/year)
Applicant HALDOR TOPSØE A/S et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1
☐ None of the figures.

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C01B3/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 551 (C-1117), 5 October 1993 & JP 05 155602 A (SEKIYU SANGYO KASSEIKA CENTER; OTHERS: 01), 22 June 1993 see abstract ---	1
A	EP 0 583 211 A (TOPSOE HALDOR AS) 16 February 1994 see column 3, line 52 - column 4, line 20 ---	1
A	EP 0 305 203 A (TOPSOE HALDOR AS) 1 March 1989 see page 2, line 55 - page 5, line 21 ---	1
A	US 4 400 309 A (MCMAHON JOSEPH F ET AL) 23 August 1983 see column 1, line 17 - line 53 ---	1
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

23 March 1999

Date of mailing of the international search report

30/03/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Clement, J-P

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 440 258 A (TOPSOE HALDOR AS) 7 August 1991 see page 5, line 36 - page 6, line 1 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

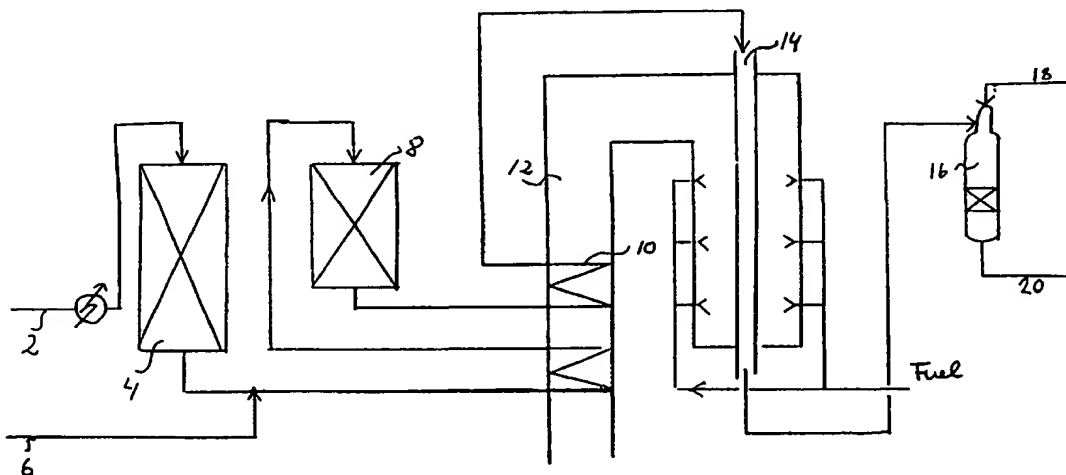
PCT/EP 98/04563

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0583211	A	16-02-1994	DK 101392 A	14-02-1994
			CA 2103939 A	14-02-1994
			DE 69300627 D	16-11-1995
			DE 69300627 T	21-03-1996
			DK 57693 A	14-02-1994
			JP 2716650 B	18-02-1998
			JP 6279002 A	04-10-1994
EP 0305203	A	01-03-1989	DK 448187 A	28-02-1989
			CA 1304215 A	30-06-1992
			DE 3885545 D	16-12-1993
			DE 3885545 T	10-03-1994
			JP 1139137 A	31-05-1989
			JP 2592662 B	19-03-1997
			US 4985230 A	15-01-1991
US 4400309	A	23-08-1983	CA 1177469 A	06-11-1984
			AU 5762073 A	09-01-1975
			CA 1008667 A	19-04-1977
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			DK 398781 A	09-09-1981
			FR 2190903 A	01-02-1974
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EP 0440258	A	07-08-1991	DK 28390 A	03-08-1991
			AT 113260 T	15-11-1994
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			CA 2035331 A,C	03-08-1991
			CN 1056850 A,B	11-12-1991
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			DE 69104735 D	01-12-1994
			ES 2065556 T	16-02-1995
			JP 1954871 C	28-07-1995
			JP 4215837 A	06-08-1992
			JP 6075670 B	28-09-1994
			SK 279079 B	03-06-1998
			RU 2053957 C	10-02-1996
			US 5167933 A	01-12-1992



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : C01B 3/38	A1	(11) International Publication Number: WO 00/05168 (43) International Publication Date: 3 February 2000 (03.02.00)
(21) International Application Number: PCT/EP98/04563 (22) International Filing Date: 21 July 1998 (21.07.98) (71) Applicant (for all designated States except US): HALDOR TOPSØE A/S [DK/DK]; Nymøllevej 55, DK-2800 Lyngby (DK). (72) Inventors; and (75) Inventors/Applicants (for US only): DYBKJAER, Ib [DK/DK]; Ndr. Frihavsgade 25, 3.tv., DK-2100 Copenhagen Ø (DK). SEIER CHRISTENSEN, Peter [DK/DK]; Glasvej 7, 1.tv., DK-2400 Copenhagen NV (DK). LUCASSEN HANSEN, Viggo [DK/DK]; Botoftevej 12, DK-2700 Brønshøj (DK). ROSTRUP-NIELSEN, J., R. [DK/DK]; Furesøvej 27, DK-2830 Virum (DK). (74) Agent: GRÜNECKER, KINKELDEY, STOCKMAIR & SCHWANHÄUSSER; Maximilianstrasse 58, D-80538 München (DE).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: SYNTHESIS GAS PRODUCTION BY STEAM REFORMING**(57) Abstract**

Process for the preparation of hydrogen and carbon monoxide rich gas by steam reforming of hydrocarbon feedstock in presence of a steam reforming catalyst supported as thin film on the wall of a reactor, comprising steps of (a) optionally passing a process gas of hydrocarbon feedstock through a first reactor with a thin film of steam reforming catalyst supported on walls of the reactor in heat conducting relationship with a hot gas stream; (b) passing effluent from the first reactor to a subsequent tubular reactor being provided with a thin film of steam reforming catalyst and/or steam reforming catalyst pellets and being heated by burning of fuel, thereby obtaining a partially steam reformed gas effluent and a hot gas stream of flue gas; (c) passing the effluent from the second reactor to an autothermal reformer; and (d) withdrawing from the autothermal reformer a hot gas stream of product gas rich in hydrogen and carbon monoxide.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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EE	Estonia	LR	Liberia	SG	Singapore		

INTERNATIONAL SEARCH REPORT

Int. Patent Application No.

PCT/EP 98/04563

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C01B3/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 551 (C-1117), 5 October 1993 & JP 05 155602 A (SEKIYU SANGYO KASSEIKA CENTER; OTHERS: 01), 22 June 1993 see abstract ---	1
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-/--		

☒ Further documents are listed in the continuation of box C.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

23 March 1999

Date of mailing of the international search report

30/03/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Clement, J-P

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/04563

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>EP 0 440 258 A (TOPSOE HALDOR AS) 7 August 1991 see page 5, line 36 - page 6, line 1 -----</p>	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ional Application No

PCT/EP 98/04563

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0583211 A	16-02-1994	DK 101392 A	14-02-1994
		CA 2103939 A	14-02-1994
		DE 69300627 D	16-11-1995
		DE 69300627 T	21-03-1996
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		JP 2716650 B	18-02-1998
		JP 6279002 A	04-10-1994
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		SE 411338 B	17-12-1979
		ZA 7304332 A	29-05-1974
EP 0440258 A	07-08-1991	DK 28390 A	03-08-1991
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		AU 624759 B	18-06-1992
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		CA 2035331 A,C	03-08-1991
		CN 1056850 A,B	11-12-1991
		CS 9100248 A	13-08-1991
		DE 69104735 D	01-12-1994
		ES 2065556 T	16-02-1995
		JP 1954871 C	28-07-1995
		JP 4215837 A	06-08-1992
		JP 6075670 B	28-09-1994
		SK 279079 B	03-06-1998
		RU 2053957 C	10-02-1996
		US 5167933 A	01-12-1992

PATENT COOPERATION TREATY

PCT

REC'D 29 SEP 1999

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

19

Applicant's or agent's file reference PCT 900-009/ej	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP98/04563	International filing date (day/month/year) 21/07/1998	Priority date (day/month/year) [21/07/1998] none
International Patent Classification (IPC) or national classification and IPC C01B3/38		
Applicant HALDOR TOPSØE A/S et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 16/04/1999	Date of completion of this report 27.09.99
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Schmidt, O Telephone No. +49 89 2399 8438 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP98/04563

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-6 as originally filed

Claims, No.:

2 as originally filed

1 as received on 08/09/1999 with letter of 08/09/1999

Drawings, sheets:

1/2,2/2 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP98/04563

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-2
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-2
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-2
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP98/04563

SECTION V.:

1.

- 1.1 The following documents D1 and D2 are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1 = EP-A-0 440 258

D2 = PATENT ABSTRACTS OF JAPAN vol. 017, no. 551 (C-1117), 5 October 1993 & JP 05 155602 A (SEKIYU SANGYO KASSEIKA CENTER; OTHERS: 01), 22 June 1993

- 1.2 D1 discloses a process for steam reforming hydrocarbons by passing the hydrocarbon feedstock into a tubular reactor consisting of a series of elongated tubes filled with conventional steam reforming Ni and/or noble metal catalysts and which is being heated by burning of fuel thereby obtaining a partially steam reformed gas effluent which in turn is passed to an adiabatic reactor to produce a product gas rich in CO and H₂ (cf. D1; page 3, lines 27-32; page 4, line 31 to page 5, line 12). D1 differs from the presently claimed process in that a steam reforming catalyst is supported as a thin film on the walls of a tubular reactor and furthermore D1 lacks utilization of waste heat in the flue gas from the primary steam reformer by heating a thin film catalyst. D2 discloses a process for steam reforming hydrocarbons by passing hydrocarbon feedstock into a reactor being heated by catalytic combustion of fuel and composed of concentrically set plate-fin compartments provided with a thin-film steam-reforming catalyst. D2 differs from the presently claimed process in that it does not suggest any means for utilizing hot flue gas from the tubular reactor in a thin film catalyst steam-reforming reactor. (cf. D2; abstract).

The subject-matter of claims 1 to 2 meets the requirements of Article 33(2)(3)(4) PCT.

SECTION VII.:

2. The term "RKNR nickel steam reforming catalyst" used on page 5 of the

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP98/04563

description appears to be a registered trade mark.

International Patent Application PCT/EP98/04563
Applicant: HALDOR TOPSØE A/S
PCT 900-00993/lh
Date: 7 September, 1999

NEW CLAIM 1

1. Process for the preparation of hydrogen and carbon monoxide rich gas by steam reforming of a hydrocarbon feedstock in the presence of a steam reforming catalyst supported as thin film on the wall of a reactor, comprising the steps of
 - (a) passing a process gas of hydrocarbon feedstock through a first reactor (10) with a thin film of steam reforming catalyst supported on walls of the reactor (10) in a heat conducting relationship with a hot gas stream of flue gas;
 - (b) passing effluent from the first reactor (10) to a subsequent tubular reactor (14) being provided with a thin film of steam reforming catalyst and/or steam reforming catalyst pellets and being heated by burning of fuel, thereby obtaining a partially steam reformed gas effluent and the hot gas stream of flue gas;
 - (c) passing the effluent from the second reactor (14) to an autothermal reformer (16); and
 - (d) withdrawing from the autothermal reformer (16) a hot gas stream of product gas (20) rich in hydrogen and carbon monoxide.

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference PCT 900-009/00	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/EP 98/ 04563	International filing date (day/month/year) 21/07/1998	(Earliest) Priority Date (day/month/year)
Applicant HALDOR TOPSØE A/S et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/04563

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C01B3/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 551 (C-1117), 5 October 1993 & JP 05 155602 A (SEKIYU SANGYO KASSEIKA CENTER;OTHERS: 01), 22 June 1993 see abstract ---	1
A	EP 0 583 211 A (TOPSOE HALDOR AS) 16 February 1994 see column 3, line 52 - column 4, line 20 ---	1
A	EP 0 305 203 A (TOPSOE HALDOR AS) 1 March 1989 see page 2, line 55 - page 5, line 21 ---	1
A	US 4 400 309 A (MCMAHON JOSEPH F ET AL) 23 August 1983 see column 1, line 17 - line 53 --- -/--	1

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search

23 March 1999

Date of mailing of the international search report

30/03/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Clement, J-P

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 98/04563

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 440 258 A (TOPSOE HALDOR AS) 7 August 1991 see page 5, line 36 - page 6, line 1 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 98/04563

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0583211	A	16-02-1994	DK 101392 A	14-02-1994
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			DE 69300627 T	21-03-1996
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			CA 1304215 A	30-06-1992
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			DE 69104735 D	01-12-1994
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			JP 1954871 C	28-07-1995
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			JP 6075670 B	28-09-1994
			SK 279079 B	03-06-1998
			RU 2053957 C	10-02-1996
			US 5167933 A	01-12-1992